TeamFour
A R C H I T E C T S

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Meeting Notes

Date:	October 1, 2009
Project:	**GSA - WO #70** **RAY ARRA Wind and PV Feasibility Study** **RAY Federal Building**
Project Numbers:	GSA Project #: IMO 00090 Team Four Project #: 29028.00
Purpose:	**On Board Review Meeting**
Date of Meeting:	**September 22, 2009**
Location:	Robert A. Young Federal Building, GSA Conference Room
Participants: GSA	Denise Ryerkerk, Project Manager Bob Minor (via phone) Dave Hartshorn (via phone) Tom Yochim, Property Manager Charlie Meyer, Field Office Director Mark Martinez, Construction Representative
Team Four/Saur Hellmuth+Bicknese	Bruce Hesterberg, Principal Wanda Evans Patrick Ladendecker
EDM	John Sonderman Roger Hagemann
Distribution:	All Participants Linda Phillips, GSA Jason Ide, GSA Mike Scarborough, GSA Vickie Ford, GSA Chris Cockrill John Nelson Ken Hollingsworth Glen Essink Gary Neuhaus – EDM Bob Warren - EDM Dan Hellmuth – Hellmuth + Bicknese Martha Pivinski – Team Four/Saur Mike Vuagniaux – Jacobs

Introduction

1. Attendees were introduced.
2. The purpose of the meeting was to review progress to date on the Feasibility Study for wind turbines, photovoltaic systems and other possible renewable energy sources for the RAY Building.

Wind and Photovoltaic Energy Options

3. Hellmuth and Bicknese shared a power point presentation. This addressed the variety of options for both wind and photovoltaic solutions, the functional roof areas, the wind speeds, solar exposures and other considerations. A copy of this presentation is available on ProjNet.
4. PV panels are most efficient if they are angled at 38 degrees. Some panels track with the sun and the seasons, changing the angle by plus or minus 15 degrees to match with the summer and winter sun angles.
5. Some of the points made during the presentation include the following: RTU's can create turbulence that can be problematic for wind turbines. Partial shading is very detrimental to PV panels. Vertical axis turbines work with wind from any direction and work at lower wind speeds. Some models of turbines can have vibration and noise issues. Average wind speed in St. Louis at 50 meters is 9.6 mph. Turbines kick out in high wind conditions for safety reasons. Mounting on a parapet minimizes vibration and can take advantage of air moving vertically up the face of the building.
6. There was considerable concern that any parapet mounted turbines would make window washing and façade repair much more difficult if not impossible and more expensive to accomplish. There was also concern that snow or ice build up on turbines that hang out over the face of the building could be a safety issue.
7. PV canopies over the windows on the south side were discussed as a possibility because of the solar exposure and the limited shading on the south. This is seen as a major problem for window cleaning. The quantity of dust that builds up makes window washing a frequent event and the canopies would make it nearly impossible.
8. Hellmuth + Bicknese mentioned local installations at the College School in Webster and at Washington University.
9. Thin film was brought up as a possibility to be installed over the existing roof. This installation would need to be coordinated with Garland in regards to the existing roof warranty and the correct thin film needs to be identified for an application in the field. **Action by Hellmuth+Bicknese/Team Four**.
10. Thin film provides less power per square foot than other panels.
11. If wind turbines are to be installed, it will necessitate an Endangered Species Act Consultation.

Technical Issues

12. EDM presented a document, "Structural Considerations" that outlines the attachment issues. This document is posted on ProjNet.
13. The design loads for wind turbines are driven by the wind loading rather than seismic loading.
14. Typically the panels clamp down to mounting bars that are anchored. The panels are light weight – 40 pounds or less.

15. Ballasting the PV system is not practical with the weights that would have to be added to the roof deck. Therefore, there will be numerous penetrations in the roof to carry any mounting bars for the PV system.
16. Penthouse B is not good for the inverters with the other stuff inside. Penthouses A or C is good.
17. Distribution boards are on the 9th floor to connect into.
18. Coordination with Ameren will be required to ensure that there is no back feed if they shut down the system. Typically the inverters go off line automatically when the power is turned off. The product selection would have to be coordinated with and approved by Ameren. **Action by EDM**.
19. Missouri has net metering so no storage of power will be required.
20. PV panels on the roof could be an issue for fire fighters. This question should be asked of local the local fire department. **Action by Team Four/Saur**.

Cost versus Payback

21. It was noted that we will need to be able to defend any energy measures that we implement. It is anticipated that a good case for the installation will have to be made to the local media.
22. The cost calculations for the energy measures will need to take into account maintenance costs and replacement costs as part of a life cycle cost. Roof replacement will also have to be figured into this analysis. PV units do require cleaning to perform well.
23. The power that is generated is converted from DC to AC.
24. Across the country, PV typically has a lower cost per kw generated than does wind.
25. A rule of thumb for PV is 4.5 kw/square meter per day.
26. Even if the payback is not there for these systems, it is possible that it might be done as a demonstration project.
27. Currently GSA purchased renewable energy and only gets a certificate for it. These funds could be diverted to equipment to produce renewable energy. The premium that is being charged by Ameren for renewable energy needs to be verified and cranked into the calculation. **Action by EDM**.
28. There is a 30% federal tax credit but that does not help a federal entity. Ameren has a 1.5 kwh credit for energy generation. There is also the $.05 incentive. Check to see whether both can be received or whether they are mutually exclusive. **Action by Team Four/Saur**.

Functional Roof Areas

29. Hellmuth + Bicknese showed a roof plan that showed viable areas for wind, viable areas for PV and areas that are problematic because of roof anchors.

Other Alternative Energy Sources

30. Solar panels to heat water were discussed.
31. PV canopies over the parking area were mentioned. There was a concern with snow and ice loads.
32. The parking areas are not conducive in that it is leased property that is city owned with state right of way. Occasionally people have to move cares to allow state access for maintenance on the highway. The end of the property on the south is at the edge of the loading dock.
33. There is also an issue with things flying off highway 40 – rocks and debris.

34. There was considerable interest in PV powered parking lot lighting. This would be a good way to demonstrate the technology in a visible way.
35. Light pollution reduction would be considered as a part of the LEED Silver.

This is my record of the decisions and discussion at this meeting. Please respond within seven days with any additions or corrections. Following that time, this document will reflect the actions and decisions of the meeting.

Respectfully,

Bruce L. Hesterberg, AIA, Principal/Project Manager

Attachments: Sign-in Sheets
Agenda
Structural Considerations

GSA RAY ARRA - Wind & Photo Voltaic Study IMO 00090

Meeting Agenda September 22, 2009

Introductions

Wind Energy

1 Technology and Equipment Options
   a. Cost versus payback
   b. Life of system
2 Functional Roof Areas
3 Wind Forces

Photovoltaic Energy

4 Technology and Equipment Options Photovoltaic Energy
   a. Cost versus payback
   b. Life of system
5 Functional Roof Areas
6 Solar Exposure

Technical Issues

7 Structural Conditions & Limitations
8 Electrical Connections & Controls

Other Discussion Items

9 Regulatory Aspects
   a. Historic
   b. Building Code
   c. Zoning Code
10 Information gathered from the Utility
   a. Retro-Commissioning Incentive
   b. Custom Incentive Program
11 Other Alternative Energy Sources and Approaches
12 LEED considerations

Schedule & Deliverables

Sept 22	On Board Workshop – Progress to Date
Week of Sept 30	95% Report Draft
Week of Oct 7	95% Report Review Meeting
Week of Oct 14	Final Report

RAY ARRA Wind and Photo Voltaic Study
Robert A. Young Federal Building
Project Number: IMO 00090

On Board Review Meeting
Date: September 22, 2009
Location: Robert A. Young Federal Building

Please print your name and the other information requested below.
Please pass to other individuals. Thank you.

Name	Representing	E-Mail Address	Phone Number
[redacted]			

FOIA, 5 U.S.C. 52 (b)(6)

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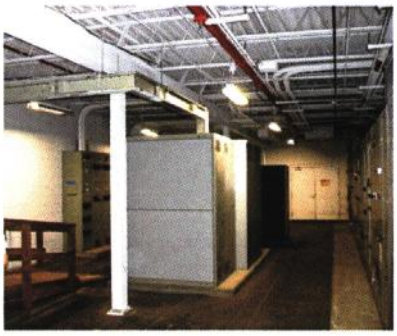
Structural Considerations

EDM Incorporated September 21, 2009

This preliminary report is offered to establish some basic information about the roof framing and how it would be affected by the installation of various types of renewable energy equipment. It is intended that as specific equipment is identified, a specific estimate of structural costs associated with that equipment would be developed.

RAY Building Structural Systems

The nine story base building is reinforced concrete construction that appears to be in good condition. The typical floor is a flat slab system with 9" floors, drop panels and column capitals. The roof is a 6 ½" slab with drop panels and column capitals.



There are mechanical penthouses on the roof that are framed in structural steel with metal roof decks. The framing was observed to be steel bar joists on steel beams and columns with bracing in the exterior walls for lateral stability. The penthouse roof framing does not carry significant piping systems.

Available Documentation

Complete drawings are available for the first phase of construction that comprised the first 7 floors and roof. These drawings are copies of originals and are not completely readable.

An incomplete set of drawings for the 8th, 9th and roof construction is available. Again the drawings available are difficult to read. More importantly the reinforcing steel schedule for the roof framing is not available. This would not permit quantitative evaluation of the impact of new roof loading imposed by renewable energy source equipment.

No drawings are available for the penthouse framing.

New Renewable Energy Equipment

Various types of photo voltaic (pv) and wind turbine systems are under consideration.

Preliminarily, crystalline pv panels inclined at 38° from horizontal are being considered. These panels typically are 5'6" by 3"4" and weight 41 pounds.

The panels will be loaded by wind and snow. The net wind load will be about 60 psf. Snow accumulation will depend upon the configuration. Snow drifting loads can be a consideration.

Vertical wind turbines seem the most likely wind energy sources. A typical style of wind turbine is shown here. The overall turbine is 18' tall and the mill is 9' wide x 14' tall.

A number of other equipment choices are possible. For this report, the two above typical systems will be considered as a starting point.

Roof Reinforcement for new loads

The weight of the photo voltaic panels plus the support framing is 3 to 5 pounds per square foot. This is a small percentage of the total roof live and dead load and can probably be shown to be acceptable.

However, the wind on the panels depending upon the configuration may create larger forces at support points. The upward and downward forces (considering a 10' by 10' support pattern and a 10' panel height) would be 4,000 pounds. Installing ballast to offset the uplift for this magnitude of loading (which would be preferable from a protection of the roof membrane point of view) would require major roof reinforcement. Since the wind load would not be combined with snow load, it is probably acceptable to install concrete anchors to hold the framing in place without reinforcing the concrete slab.

If the panels are located on the penthouse roofs, local reinforcement of the steel framing will be required at each support. The structural reinforcement cost of installing these panels over large areas of the penthouse roof would be $1,500 per location divided by 100 square feet or $15 per square foot.

The wind turbine described above would have an insignificant weight but in high winds would impose over-turning forces on the supporting roof. It is roughly estimated that the overturning

moment at the base of this type of turbine would be 30 foot kips. For the concrete roof a base for the mast holding the mill of 30" by 30" with 10 - 3/4" $^{\varphi}$ thru-slab roof bolts would resist that moment without other roof slab reinforcement. For the penthouse roofs, steel reinforcement would be necessary. The cost of reinforcing the roof at each of these turbines would be about $2,500.